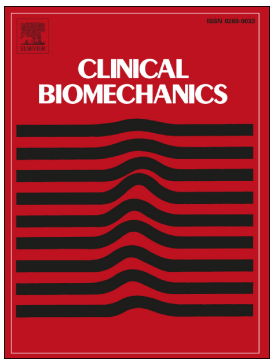

Potential of electrical impedance spectroscopy to differentiate between healthy and osteopenic bone

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PII: S0268-0033(18)30460-1
DOI: doi:10.1016/j.clinbiomech.2018.05.014
Reference: JCLB 4541

To appear in: *Clinical Biomechanics*

Received date: 11 October 2017
Accepted date: 25 May 2018

Please cite this article as: Payal Bhardwaj, Durg V. Rai, Mohan L. Garg, Biraja P. Mohanty , Potential of electrical impedance spectroscopy to differentiate between healthy and osteopenic bone. Clinical Biomechanics (2017), doi:10.1016/j.clinbiomech.2018.05.014

Potential of electrical impedance spectroscopy to differentiate between healthy and osteopenic bone

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Abstract

Background: Osteoporosis involves loss of structural stability of bone due to an increase in bone porosity. Dual energy X-ray absorptometry is used to evaluate bone in terms of quantity. However, it does not give an evaluation of the patient's bone quality. For this, present study has been carried out to assess the structural deterioration of bone using electrical impedance spectroscopy.

Methods: Electrical Impedance Spectroscopy has been applied to evaluate the structural and compositional changes of cortical bone in the frequency range of 50 Hz to 5 MHz for the ovariectomized rat model. Initially, bone resorption in the ovariectomized group has been confirmed by estimating tartaric resistant acid phosphatase levels; morphometric parameters; bone matrix components, hydroxyapatite crystallite size and bone micro architecture. The mid diaphyseal regions from the femora and tibiae of sixty days post ovariectomy and control rats were used for the measurement of dielectric parameters. A dispersion model based analysis has been developed by a complex least square fitting of the dielectric data.

Findings: Increased tartaric resistant acid phosphatase levels, altered bone matrix components, hydroxyapatite crystallite size and disturbed microarchitecture in the ovariectomized group give us the confirmation of increased bone resorption following estrogen deficiency. These changes were shown to be reflected by single dispersion model based fitted parameters which shows the considerable change in all the parameters of ovariectomized group compared to the control.

Interpretation: It has been demonstrated that the parameters of the dispersion model can reflect the bone structural and compositional changes.

Key words: Electrical Impedance Spectroscopy; Osteopenia; Rat Cortical Bone; Femur; Tibia; Dielectric Dispersion Model

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